

## PATENT SPECIFICATION

DRAWINGS ATTACHED

Inventors: FREDERICK LEWIS DAVIS and EDWARD JOHN ALBERT DAVIS

911654



Date of filing Complete Specification Aug. 22, 1961.

Application Date Aug. 23, 1960.

No. 29141/60.

Complete Specification Published Nov. 28, 1962.

## ERRATA

SPECIFICATION No. 911,654  
Amendment No. 1

Page 1, line 84, for "sub-arm" read "sub-arms"

Page 4, line 40, for "64" read "63"

THE PATENT OFFICE  
4th April 1966

ment:—

10 This invention relates to apparatus for the manufacture of hollow articles by dipping.

It has been proposed to provide an automatic machine for this purpose, in which the formers on which the articles are formed were carried on arms pivotally attached to a chain forming a closed loop, the chain being driven to carry the formers through positions at which the various operations necessary for the production of the articles took place. Each arm was pivotally attached to a lateral projection on the chain so as to be movable in a plane perpendicular to the length of the chain, and each former was rotatably mounted about its own axis on the arm. Dipping was effected by moving the arm from a laterally extending position to a vertically dependent position, its movement being controlled by a suitably contoured guide rail engaging the arm, the rate of immersion and withdrawal of the formers during dipping being controlled by the shape of the guide rail so that the chain could be driven at a uniform speed and not deflected vertically during dipping.

35 It has been found advantageous to provide for vertical movement of the formers into and out of the dipping baths as distinct from the swinging movement inherent in the apparatus as previously proposed, and the object of the present invention is to provide an apparatus in which such vertical movement can be provided without affecting the uniform speed of the chain.

for pivotal movement relative to the said former-carrying arms about axes parallel to the pivot axes of said arms and are adapted to hang downwardly from said arms, supporting means for the said arms being provided which include means for swinging the arms about their pivots to produce vertical movement of the formers.

The supporting means may include cam-like portions guiding the said arms for pivotal movement.

Alternatively, the supporting means may include upwardly and downwardly movable bars on which the said arms are supported for pivotal movement.

Means may be provided which act on the formers to swing them about their pivotal mountings on the arms away from their downwardly hanging positions and to support them in the positions to which they are so moved.

The formers are preferably mounted on the former-carrying arms for rotation about axes extending longitudinally of the said formers.

Means may be provided to engage the formers when they are displaced from their downwardly hanging positions and to rotate them about the said longitudinally-extending axes.

A plurality of formers may be mounted on each former-carrying arm, each former being mounted for rotation about an axis extending longitudinally thereof on a sub-arm movable about the pivotal mounting on the arm, the sub-arm being arranged in

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Index at acceptance:—Class 87(2), A7(A:C5).

International Classification:—B29d.

## COMPLETE SPECIFICATION

### Improvements in or relating to Apparatus for the Manufacture of Hollow Articles by Dipping

We, LONDON RUBBER COMPANY LIMITED, a British Company, of Hall Lane, Chingford, London, E.4, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to apparatus for the manufacture of hollow articles by dipping.

It has been proposed to provide an automatic machine for this purpose, in which the formers on which the articles are formed were carried on arms pivotally attached to a chain forming a closed loop, the chain being driven to carry the formers through positions at which the various operations necessary for the production of the articles took place. Each arm was pivotally attached to a lateral projection on the chain so as to be movable in a plane perpendicular to the length of the chain, and each former was rotatably mounted about its own axis on the arm. Dipping was effected by moving the arm from a laterally extending position to a vertically dependent position, its movement being controlled by a suitably contoured guide rail engaging the arm, the rate of immersion and withdrawal of the formers during dipping being controlled by the shape of the guide rail so that the chain could be driven at a uniform speed and not deflected vertically during dipping.

It has been found advantageous to provide for vertical movement of the formers into and out of the dipping baths as distinct from the swinging movement inherent in the apparatus as previously proposed, and the object of the present invention is to provide an apparatus in which such vertical movement can be provided without affecting the uniform speed of the chain.

According to the present invention, in apparatus for the manufacture of hollow articles by dipping and including former-carrying arms pivotally mounted on an endless driving chain for movement in a plane transverse to the direction of movement of the said chain, the formers are mounted for pivotal movement relative to the said former-carrying arms about axes parallel to the pivot axes of said arms and are adapted to hang downwardly from said arms, supporting means for the said arms being provided which include means for swinging the arms about their pivots to produce vertical movement of the formers.

The supporting means may include cam-like portions guiding the said arms for pivotal movement.

Alternatively, the supporting means may include upwardly and downwardly movable bars on which the said arms are supported for pivotal movement.

Means may be provided which act on the formers to swing them about their pivotal mountings on the arms away from their downwardly hanging positions and to support them in the positions to which they are so moved.

The formers are preferably mounted on the former-carrying arms for rotation about axes extending longitudinally of the said formers.

Means may be provided to engage the formers when they are displaced from their downwardly hanging positions and to rotate them about the said longitudinally-extending axes.

A plurality of formers may be mounted on each former-carrying arm, each former being mounted for rotation about an axis extending longitudinally thereof on a sub-arm movable about the pivotal mounting on the arm, the sub-arm being arranged in

pairs the relative movement of which is restricted by stop means so that the said sub-arms tend to assume positions in which they extend laterally in opposite directions from the pivotal mounting with the formers hanging vertically downwardly therefrom.

The invention is hereinafter described with reference to the accompanying drawings, in which:—

Figure 1 is a transverse sectional elevation of one form of apparatus according to the invention;

Figure 2 is a partial side elevation of the apparatus shown in Figure 1, some of the formers and former-carrying arms being omitted;

Figure 3 is a side elevation similar to Figure 2 but with further parts omitted;

Figure 4 is a plan view of a part of the apparatus showing the chain and former-carrying arms;

Figure 5 is a partial transverse section on the line 5—5 of Figure 2;

Figure 6 is a transverse section similar to Figure 5 but showing the parts in a different position;

Figure 7 is a partial transverse section on the line 7—7 of Figure 2;

Figure 8 is an end view of a detail;

Figure 9 is a side view of the parts shown in Figure 8;

Figure 10 is an end view similar to Figure 8 but showing the parts in another position;

Figure 11 is a side view showing an alternative mechanism for controlling dipping of the formers; and

Figure 12 is a cross-sectional view showing the mechanism of Figure 11.

Referring to the drawings, and more particularly to Figures 1, 2 and 3 thereof, the apparatus comprises an endless twin link roller chain 10 supported on guide tracks in a frame 11 and passing over sprockets (not shown) at the ends of the frame so as to form lower and upper runs 12 and 13, the chain 10 being driven by an electric motor (not shown) coupled to one of the sprockets.

The frame 11 has been omitted from Figure 2 to provide clearer illustration of the working parts of the apparatus.

As shown in Figure 1, the chain 10 is a twin roller chain provided with rollers 14 at the pivots between adjacent links thereof, the rollers 14, on the lower run 12 of the chain, running on guide rails 15 and being restrained against upward movement by guide rails 16. Similar guide rails 17 and 18 are provided to guide the rollers 14 on the upper run 13 of the chain, and on both runs the said guide rails are horizontal throughout their length, so that the chain deviates from a horizontal path only

when it passes round the sprockets at the ends of the frame 11.

To each link at each side of the chain 10 there is secured a generally U-shaped bracket 19. A former-carrying arm 21, forked at its ends as shown in Figure 4, is pivoted at its inner end to the limbs of each bracket 19 so as to be capable of swinging, relative to the chain, in a plane transverse to the direction of movement of the latter, and has a spindle 22 extending between the limbs of the fork at its outer end, the spindle 22 also being parallel to the direction of movement of the chain. Four sub-arms 23 are pivoted on the spindle 22, the sub-arms 23 being shaped as shown in Figures 1 and 4 so that adjacent sub-arms extend in opposite directions from a plane containing the axis of the spindle 22. Each sub-arm 23 has mounted on it a former 24 for an article to be produced, the formers 24 shown in the drawings being for the production of gloves. The formers are mounted on the sub-arms 23 for rotation about axes parallel to the length of the said formers and are provided with cylindrical portions 25 at their upper ends. One of each two adjacent sub-arms is provided with an abutment 26 to be engaged by the other sub-arm of the pair and hold the said sub-arms in such relative positions that the formers carried thereby hang vertically under the force of gravity. Each former-carrying arm 21 has mounted on it, intermediate its ends, a roller 27, and tracks are provided on the frame 11 on which the rollers 27 rest, the said tracks determining the angular position, relative to the chain 10, of the former-carrying arms 21. The tracks on which the rollers 27 rest, where the angular position of the former-carrying arms 21 is required to remain constant over a substantial distance of travel of the chain, comprise rails 28 parts of which are shown at both ends of Figure 2, but, where changes in the angular position of the arms 21 are required, for example to lower the formers into, and lift them out of a dipping tank, the said tracks are formed by the cam-like edges of plates 29 one of which is shown in Figures 2 and 7. As shown in Figure 2, the cam plate 29 is arranged above a dipping tank 30, its edge on which the rollers 27 rest being so shaped that the formers move downwardly into the tank at a predetermined rate until they are partially immersed in the liquid in the tank, continue to move at a greater rate until they are fully immersed and then travel horizontally over a predetermined distance, after which are raised clear of the liquid at a constant rate.

In the production of rubber articles by the dipping process, the formers are usually first dipped into a coagulant solution and then into a dispersion of rubber latex. In

apparatus designed for the production of various articles, such as gloves, toy balloons and the like, it may be necessary to use different dispersions of rubber latex for different articles, for example dispersions containing pigments of different colours so that the articles produced are of different colours. To avoid the necessity of emptying, cleaning and refilling the tanks when a change in the dispersion used is required, a number of dipping tanks containing the different dispersions may be arranged at different positions along the travel of the chain, a cam plate 29 being provided over each tank, and means may be provided for preventing the formers from dipping into any tank containing a dispersion not to be applied to those formers.

For this purpose, each former-carrying arm 21 has mounted on it a bracket 31 carrying an auxiliary roller 32 (Figures 1, 4, 5, 6, and 7) and an auxiliary track 33 (Figures 1 and 2) to be engaged by the auxiliary rollers 32 is mounted above each cam plate 29. A gate 34 (Figures 2 and 7), movable into and out of alignment with the auxiliary track 33, is provided to lead the rollers 32 on to the auxiliary track 33, the gate 34, when in alignment with the auxiliary track being engaged by the rollers 32 before the corresponding rollers 27 reach the commencement of the corresponding cam edge on the plate 29. The gate 34 may be mounted for pivotal movement about an axis parallel to the length of the auxiliary track 33, and moved about its pivot by air pressure operating in a suitable ram-and-cylinder device 35. At the end of the auxiliary track 33 where the auxiliary rollers disengage it and the supporting of the arms 21 is transferred back to the main track 28, a pivoted frog 36 is provided to allow passage of the auxiliary rollers 32 on former-carrying arms 21 which have been supported on the cam plate 29 during their passage over a dipping tank.

After the formers have left a dipping tank the material deposited thereon is dried and cured. It has been found advantageous to support the formers in a horizontal attitude during these operations, and to rotate them about their axes. The following description relates to means for moving the formers from a vertical to a horizontal position and bringing the cylindrical portions 25 thereof into rolling engagement with fixed tracks 37 on the frame of the apparatus.

The formers 24 are moved from the vertical to the horizontal position by a bar 38, Figure 2, mounted on a bracket 39 coupled by a parallel linkage 41 to fixed supports on the frame of the apparatus as shown in Figures 5 and 6, the bar 38 being arranged to engage the cylindrical portions 25 of the two formers 24 on the sub-arms 23 which extend inwardly from their pivots on a former-carrying

arm 21 and, due to the swinging movement of the parallel linkage 41, to swing those formers upwardly and outwardly to a horizontal position. The other pair of formers 24 on the same former-carrying arm move with the two which are engaged by the bar 38, the movement being transmitted to them through the abutments 26. Movement of the parallel linkage 41 is effected by a fluid pressure operated ram working in a cylinder 42 and pivotally coupled to an arm 43 fixed to one arm of the parallel linkage 41, the arm 43 being coupled by a link 44 to a corresponding arm 45 fixed to the other arm of the parallel linkage. The bar 38 is so positioned relative to the end of the cam plate 29 at which the former-carrying arms 21 leave the said cam plate that the cylindrical portions of formers on each said arm 21 come opposite it as they leave the said cam plate, the bar then being in the position shown in Figure 5. The ram in the cylinder 42 is then operated to move the said bar 38 to the position shown in Figure 6, moving the formers to the horizontal position as shown in that figure. The bar 38 is, of course, long enough to allow for the travel of the chain 10 during the turning movement, so that the formers do not ride off it during such movement.

A carriage 46 (Figures 2, 3 and 6), mounted, to reciprocate in the direction of movement of the chain 10 through a predetermined stroke, on a fixed track 47, carries two endless belts 48, 49 driven by an electric motor 51 on the carriage 46, the belts 48, 49 being horizontally disposed with their upper runs in planes such that they lie just below the cylindrical portions of the two pairs of formers 24 on a former-supporting arm 21 when the said formers are horizontal. The movement of the carriage 46 is such that, in one extreme position, the belts 48, 49 overlap the bar 38, as shown in dotted lines in Figure 3, and in the other extreme position, the carriage having moved in the direction of travel of the chain 10, the belts are clear of the bar 38 as shown in full lines in Figure 3. The tracks 37, which are of a level slightly below that of the upper runs of the belts, extend to within a short distance of the adjacent end of the bar 38. The belts 48, 49 thus serve to pick up the formers from the bar 38 and transfer them to the fixed tracks 37, allowing the bar 38 to return to its position shown in Figure 5 as soon as it has lifted the formers, ready to act on the formers mounted on the next former-carrying arm 21. The belts 48, 49 may be driven at any desired speed depending on the speed of rotation of the formers desired, thus enabling them to be rotated at a speed independent of the speed of the chain 10 until they run on to the fixed tracks 37.

The carriage 46 is moved to-and-fro by a fluid-pressure operated ram working in a cylinder 52 fixed to the frame of the apparatus, and is coupled to the chain 10 during its travel in the same direction as the said chain so as to ensure that it moves at the same speed as the said chain. The coupling of the carriage to the chain is effected by two arms 53 and 54 of equal length, each pivoted at one end to the frame of the apparatus and interconnected by a link 55 lying parallel to a line joining the pivots of the said arms. The arm 53 is pivoted at its other end to the carriage 46, and the arm 54 carries a releasable latch device 56 adapted to engage with any one of the cross-rods 57 which connect the two sides of the twin roller chain 10.

The latch device 56 is shown in detail in Figures 8, 9 and 10 and comprises an angle member 58 one arm of which is pivotally attached at 59 to the upper end of the arm 54, the other arm of the angle member being notched as shown at 61 in Figure 9 to embrace any one of the cross-rods 57. The angle member 58 is urged by a spring 62 to the position shown in Figures 8 and 9, in which it is capable of engaging a cross-rod 57, but is movable against the resistance of the spring 62 to a release position shown in Figure 10. Movement of the angle member to the release position is effected by engagement of a rocking member 63 pivoted on the arm 54 with a fixed adjustable stop 64 on the frame of the apparatus, the rocking member 63 being coupled by a chain 65 to a lug 66 projecting from the angle member 58. The stop 64 is, of course, so positioned that it is engaged by the rocking member 64 when the carriage 46 reaches the end of its travel in the same direction as the chain 10, this position being shown in Figure 10.

The formers may be returned to the vertical, downwardly hanging position by a device similar to that described for raising them to the horizontal position, but working in the opposite direction, or by allowing the cylindrical portions of the two formers which are lowermost in the horizontal position to run down a helical guide track the upper end of which mates with the lower track 37.

The formers are shown in Figure 1, on the upper run of the chain 10, as being in upwardly extending vertical positions, which positions they are required to assume during some stages to the production cycle, and they may be moved to this position by helical tracks acting on the cylindrical portions of the formers, or, if they are moved to the upwardly extending vertical position from the horizontal position, by a device similar to that used to raise them to the horizontal position. The formers are retained in the upwardly extending vertical position by tracks

67, Figure 1, engaged by the cylindrical portions of the formers.

It has been found that, owing to lack of uniformity in the weight of the formers, or to friction in the pivots of the sub-arms 23, the pairs of formers may not hang in truly vertical positions when suspended freely. Means are therefore provided to urge them positively into the vertical position as they descend into a dipping bath, thus ensuring that both formers of a pair are immersed to the same depth.

The means for this purpose are shown in Figures 2 and 7, and include a frame 68, carried by parallel linkage 69 the upper links of which are pivoted and slidable on a horizontal rod 71, carried by the frame 11; whilst the lower limbs are fixed to a horizontal rod 72 slidable and rotatable in the frame 11. The frame 68 has mounted thereon at its lower end two fork members 73 each arranged to embrace the spindle 22 on which the sub-arms 23 are mounted and to press downwardly on the said sub-arms. The frame 68 also has fixed to it a dependent arm 74 adapted to engage with one limb of the forked end of the former-carrying arm 21 and cause the said frame to be carried along by the said arm 21 as the chain 10 moves. The frame 68 normally occupies a raised position, shown in full lines in Figure 7, and is at the right-hand end of its horizontal movement as shown in Figure 2. The said frame is moved vertically by a fluid pressure operated ram acting in a cylinder 75, the timing of the downward movement being such that the fork members 73 engage the sub-arms 23 at a predetermined point during the downward movement of the formers, the dependent arm 74 being engaged by the former-carrying arm so that the frame 68 travels forwardly with the chain 10. A helical cam 76 is mounted to rotate about the rod 72 with the parallel linkage 69, and co-operates with a fixed peg 77, during upward movement of the frame 68, to return it horizontally to its normal position.

The admission of fluid pressure to the various cylinders to operate the frame 68, the bar 38 and the carriage 46 is controlled in timed relation to the movement of the chain 10 so that the group of formers on each former-carrying arm 21 are steadied as they dip into the tank 30, are swung to the horizontal position when they have left the tank, and are transferred, in the horizontal position to the rails 37. If a group of formers is required to by-pass a dipping tank, the gate 34 is brought into alignment with the auxiliary track 33 as that group of formers approaches.

Whilst it is usually satisfactory to control the entry of formers into a dipping tank and their withdrawal therefrom by means of the cam plates 29, it is sometimes desirable

to provide for more rapid entry of the formers into, or more rapid removal of the formers from the dipping tank. This can be done by providing a bar 78, Figures 11 and 12, to support the former-carrying arms 21, and  
 5 arranging for the said bar to be moved downwardly and upwardly by fluid pressure acting on a ram slidable in a cylinder 79. The bar 78 is carried by pivoted arms 81 to  
 10 one of which the ram is coupled. The former-carrying arms 21 are supported up to the position where the rollers 27 thereon engage the bar 78 by the engagement of the auxiliary rollers 32 thereon with an  
 15 auxiliary track 38, and are similarly supported after leaving the bar 78.

The mechanism described herein for swinging the formers from a vertical dependent position to a horizontal position may be replaced by curved cam tracks engaging the  
 20 cylindrical portions 25 of one pair of formers 24 in the group carried by each arm 21, the said cam tracks leading the formers on to belts similar to the belts 48 and 49 but  
 25 mounted on a fixed frame.

#### WHAT WE CLAIM IS:—

1. Apparatus for the manufacture of hollow articles by dipping and including former-carrying arms pivotally mounted on an endless driving chain for movement in a plane  
 30 transverse to the direction of movement of the said chain, wherein the formers are mounted for pivotal movement relative to the said former-carrying arms about axes parallel  
 35 to the pivot axes of said arms and are adapted to hang downwardly from said arms, supporting means for the said arms being provided which include means for swinging the arms about their pivots to produce vertical  
 40 movement of the formers.

2. Apparatus according to Claim 1, wherein the supporting means include cam-like portions guiding the said arms for pivotal  
 45 movement.

3. Apparatus according to Claim 1, wherein the supporting means include upwardly and downwardly movable bars on which the said  
 50 arms are supported for pivotal movement.

4. Apparatus according to Claim 1, 2 or 3, wherein means are provided which act

on the formers to swing them about their pivotal mountings on the arms away from their downwardly hanging positions and to support them in the positions to which they  
 55 are so moved.

5. Apparatus according to any preceding claim, wherein the formers are mounted on the former-carrying arms for rotation about  
 60 axes extending longitudinally of the said formers.

6. Apparatus according to Claim 5, wherein means are provided to engage the formers when they are displaced from their downwardly hanging positions and to rotate them  
 65 about the said longitudinally-extending axes.

7. Apparatus according to any preceding claim, wherein a plurality of formers are mounted on each former-carrying arm, each former being mounted for rotation about an  
 70 axis extending longitudinally thereof on a sub-arm movable about the pivotal mounting on the arm, the sub-arms being arranged in pairs the relative movement of which is restricted by stop means so that the said  
 75 sub-arms tend to assume positions in which they extend laterally in opposite directions from the pivotal mounting with the formers hanging vertically downwardly therefrom.

8. Apparatus according to Claims 4, 5, 6 and 7, wherein the formers are swung from their downwardly hanging positions by a bar  
 80 mounted on a parallel linkage and are engaged after movement by said bar by endless belts mounted on a carriage movable to-and-fro in the direction of movement of the roller chain,  
 85 said belts supporting the formers and leading them on to fixed supporting rails.

9. Apparatus according to any preceding claim, wherein means are provided to hold the formers in vertical positions during their  
 90 downward movement for dipping.

10. Apparatus for the manufacture of hollow articles for dipping, substantially as described with reference to, and as shown in, the  
 95 accompanying drawings.

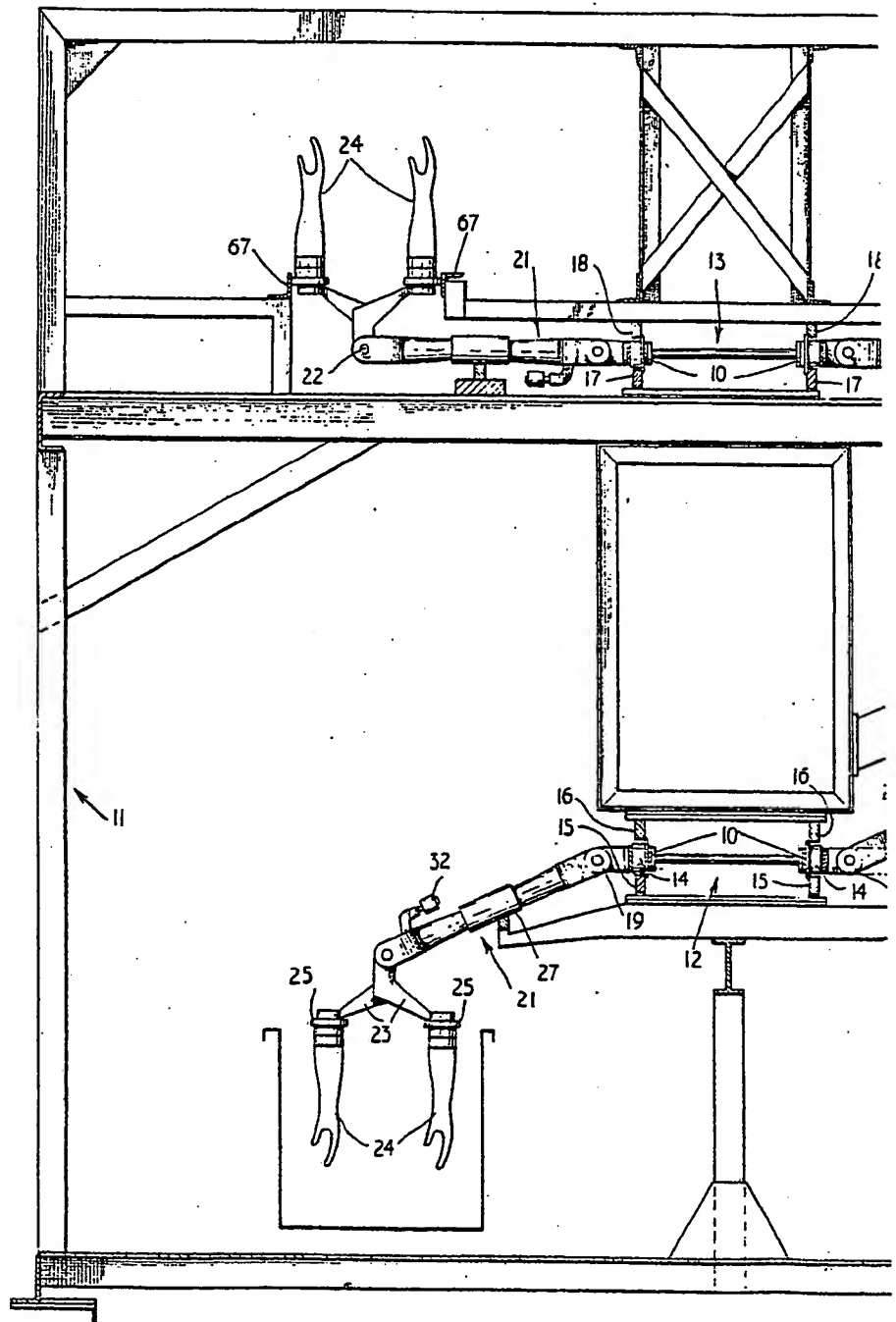
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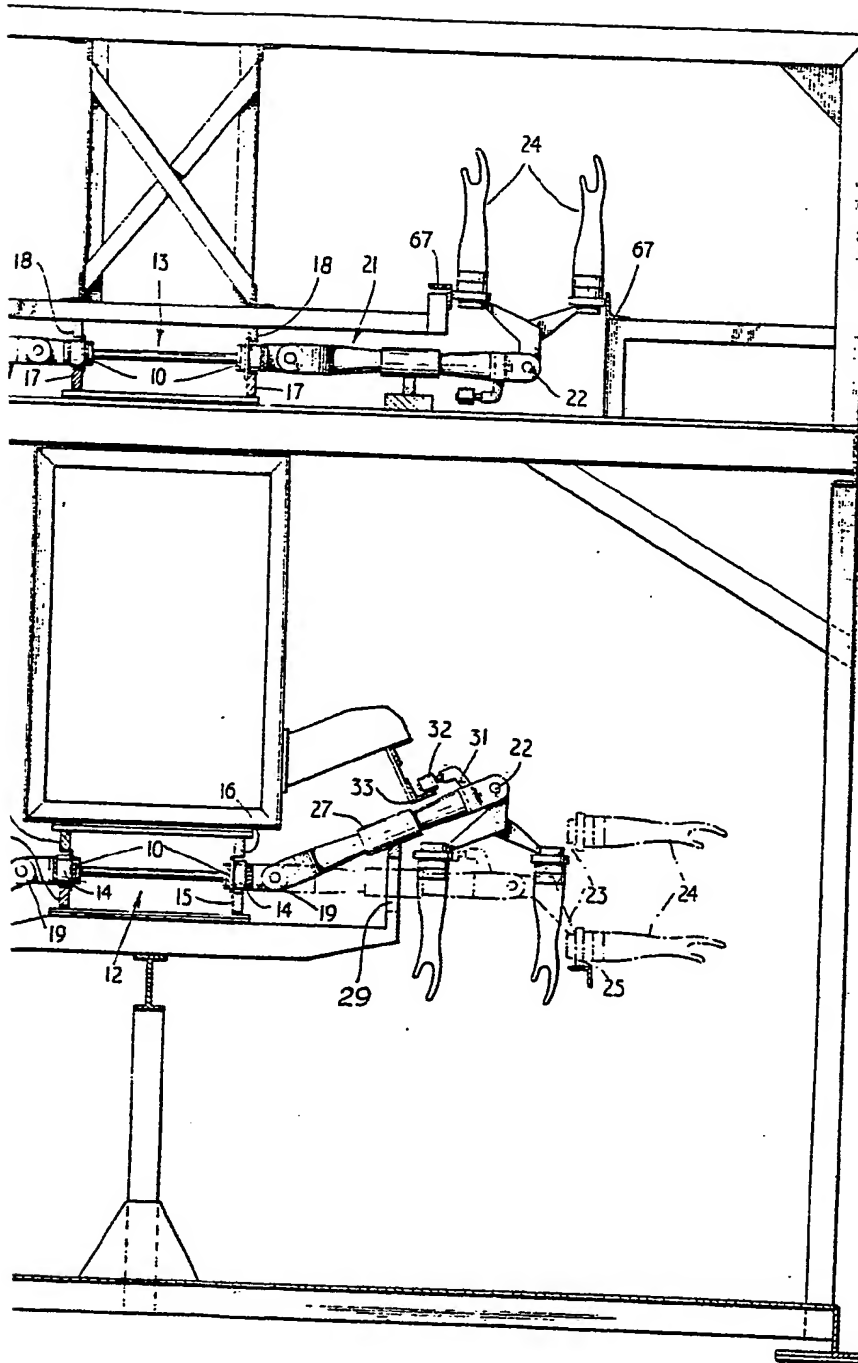
F. J. CLEVELAND & COMPANY,  
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FIG. 1







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5 SHEETS Sheet 1

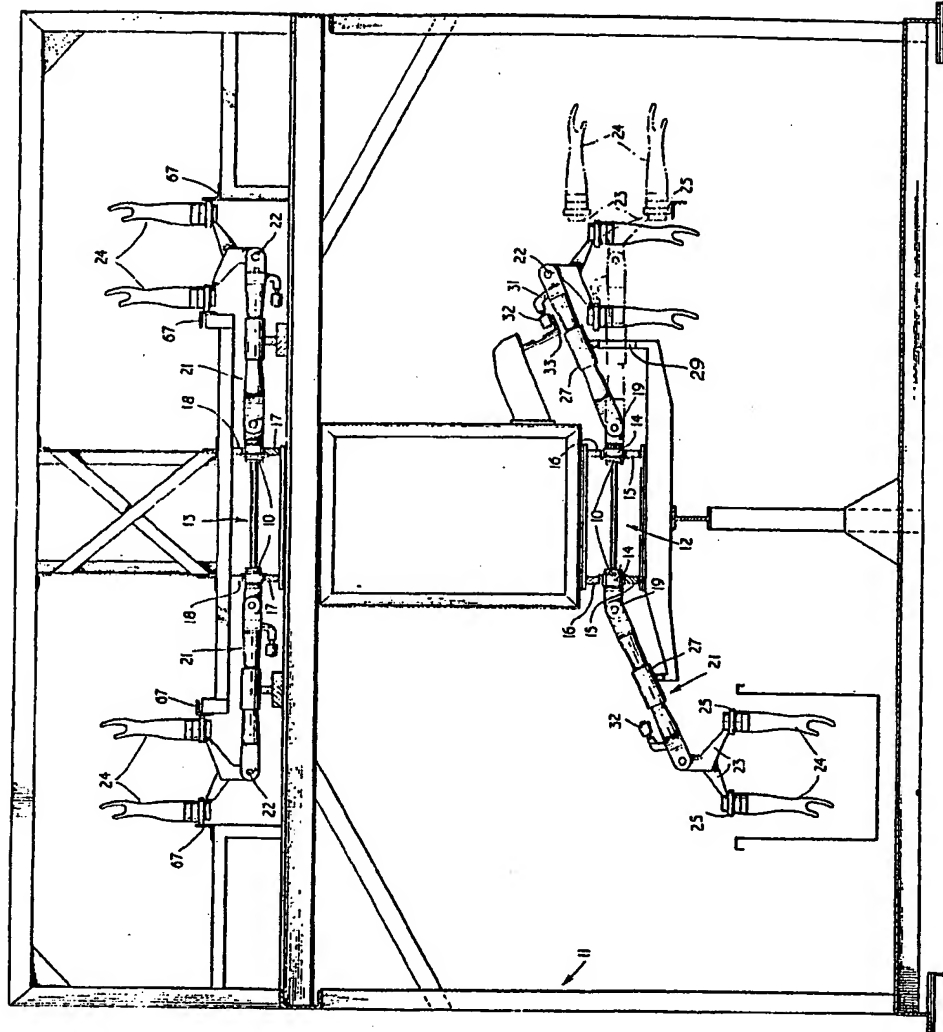


FIG. I

FIG. 2.

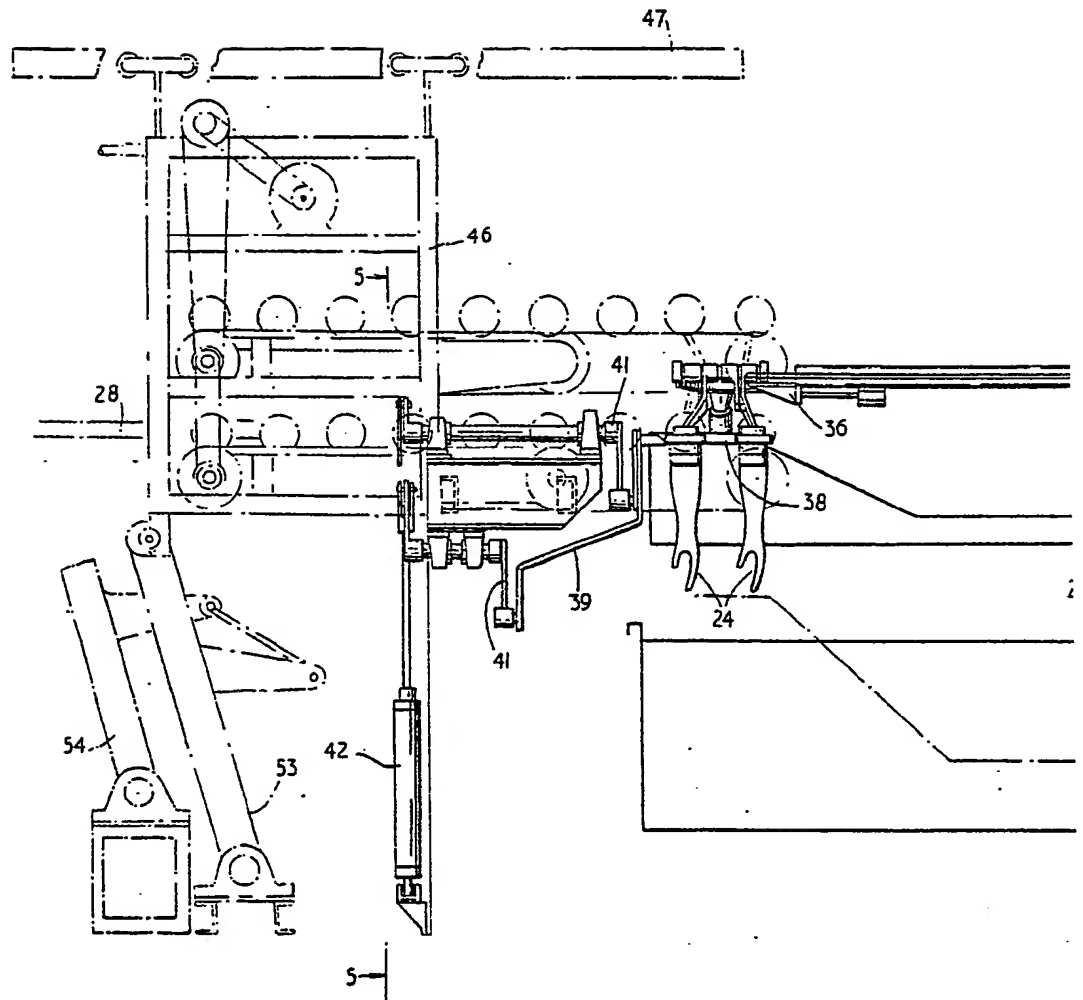




FIG. 2.

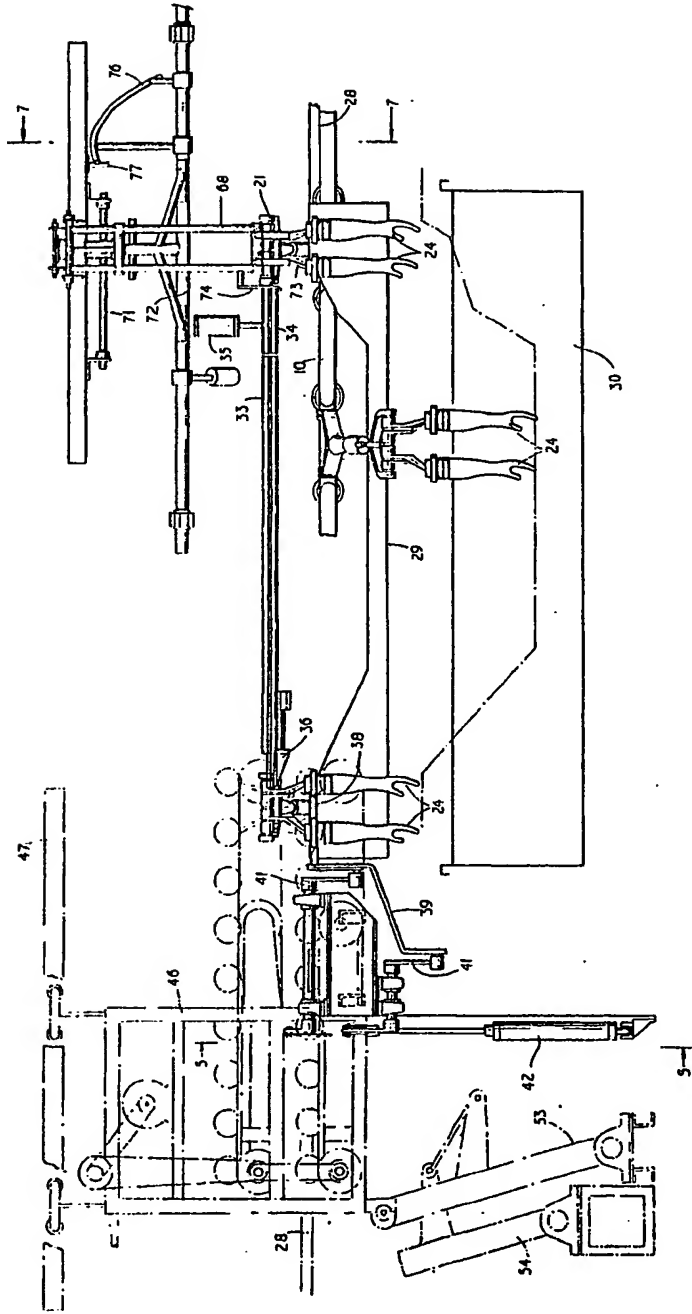


FIG. 3

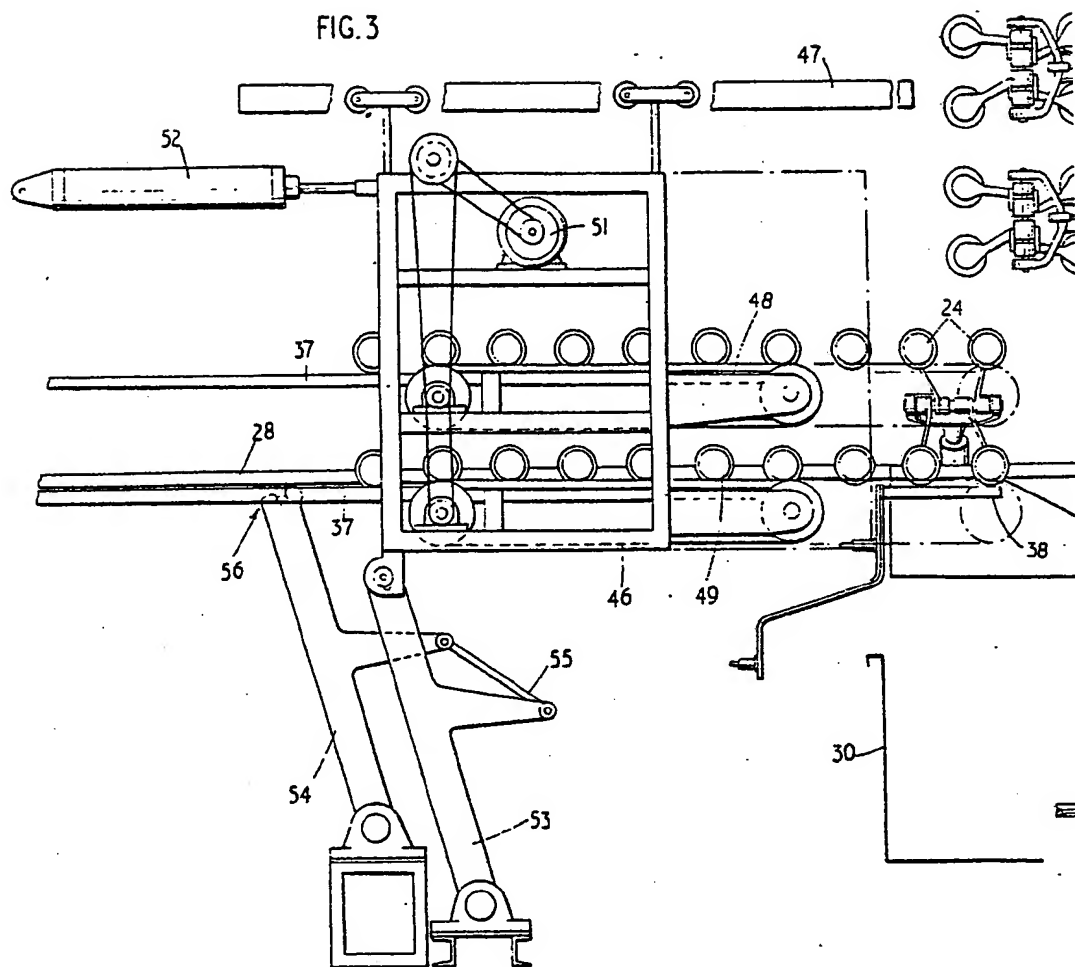


FIG. 4.

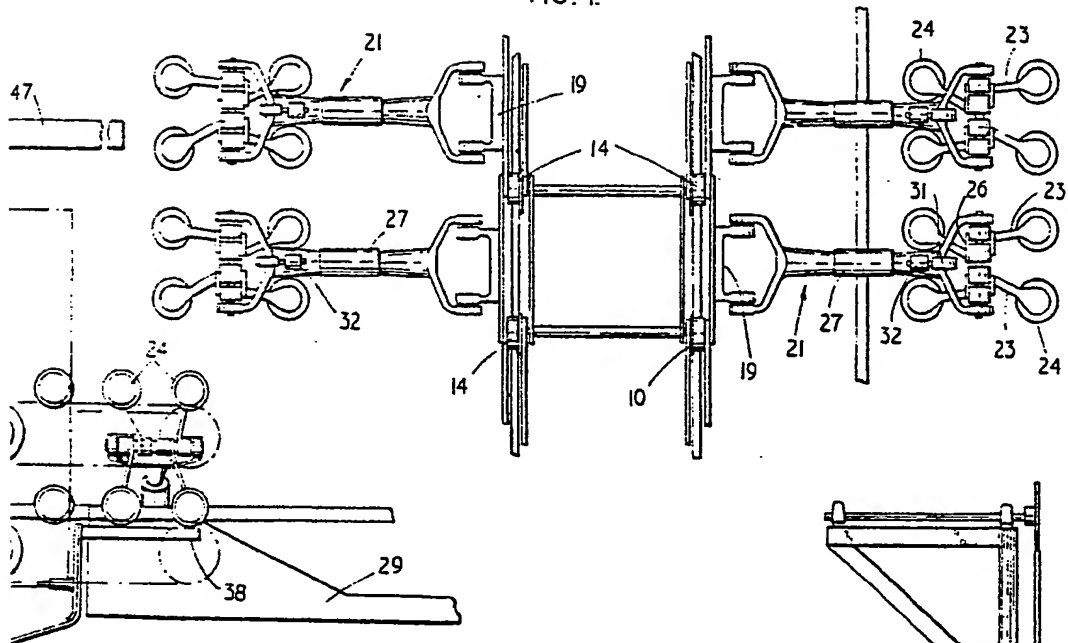
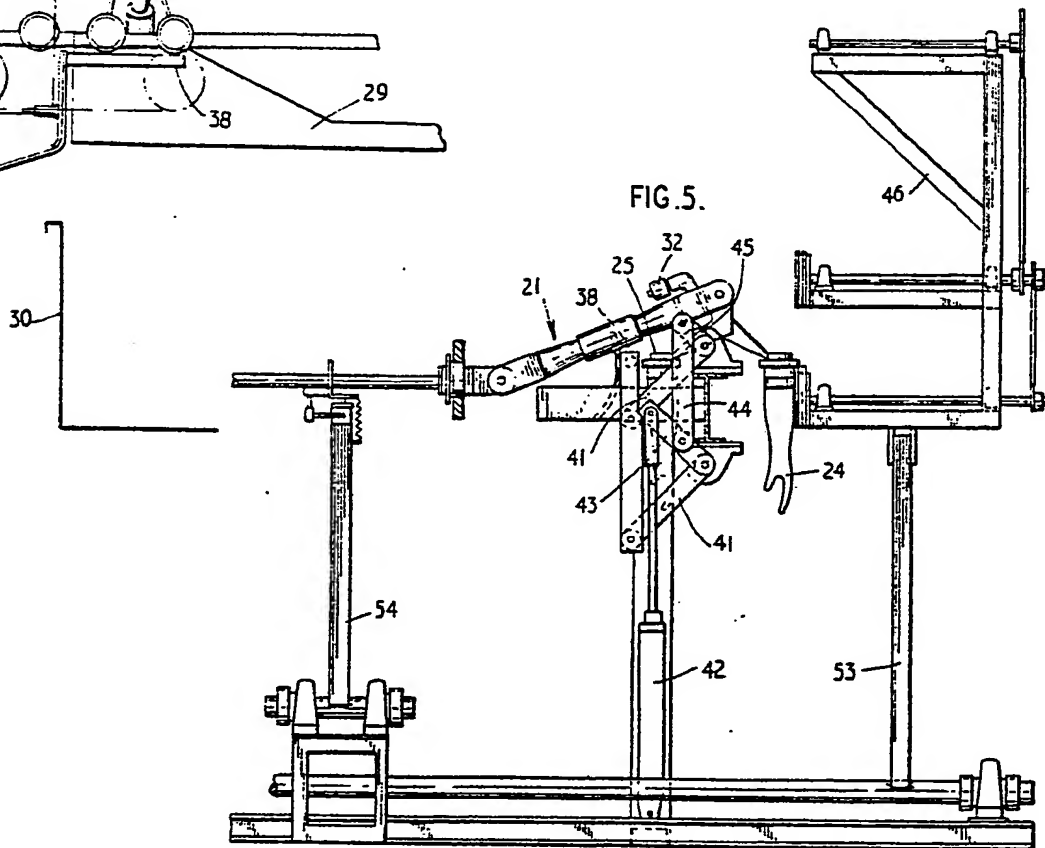


FIG. 5.



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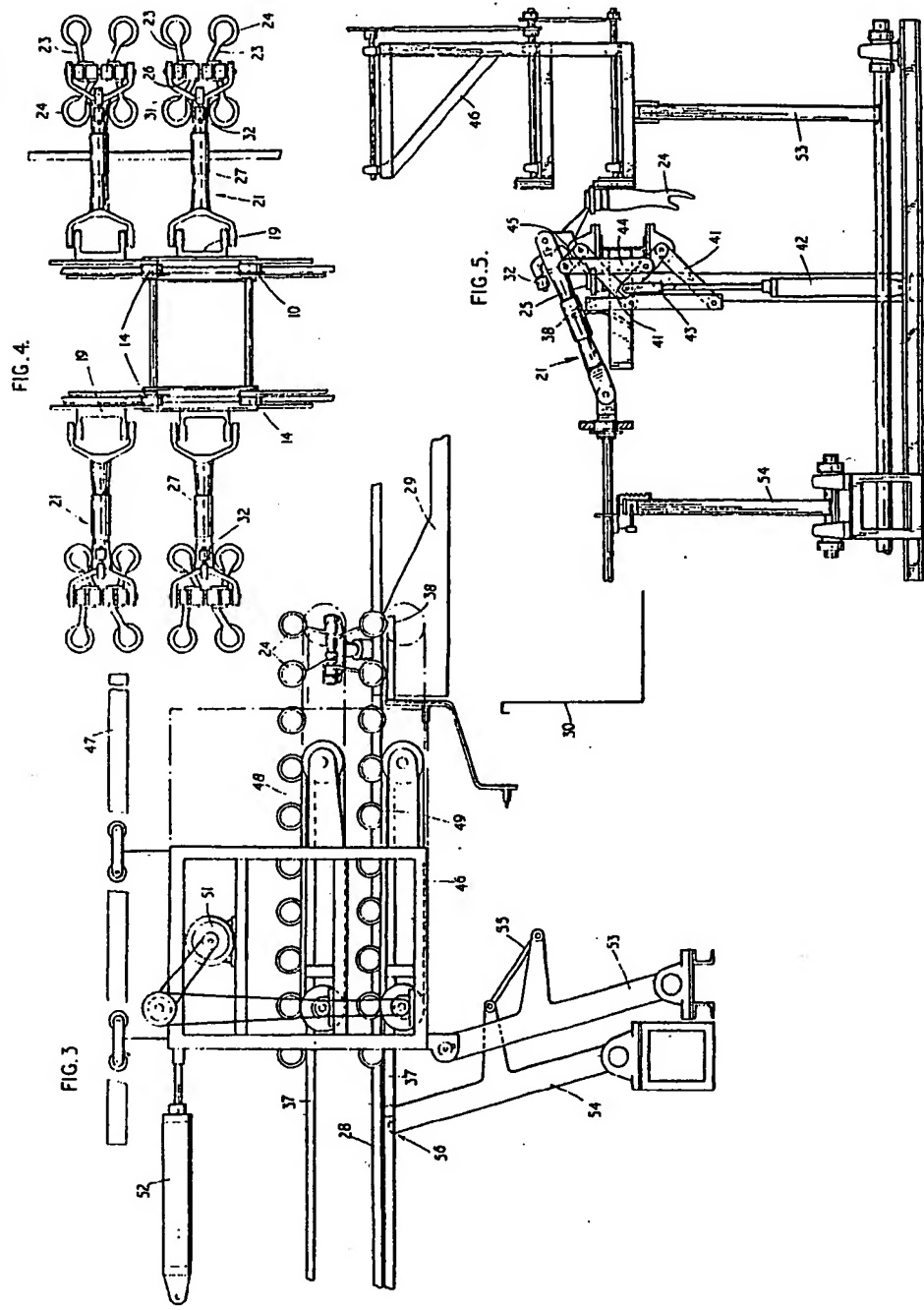
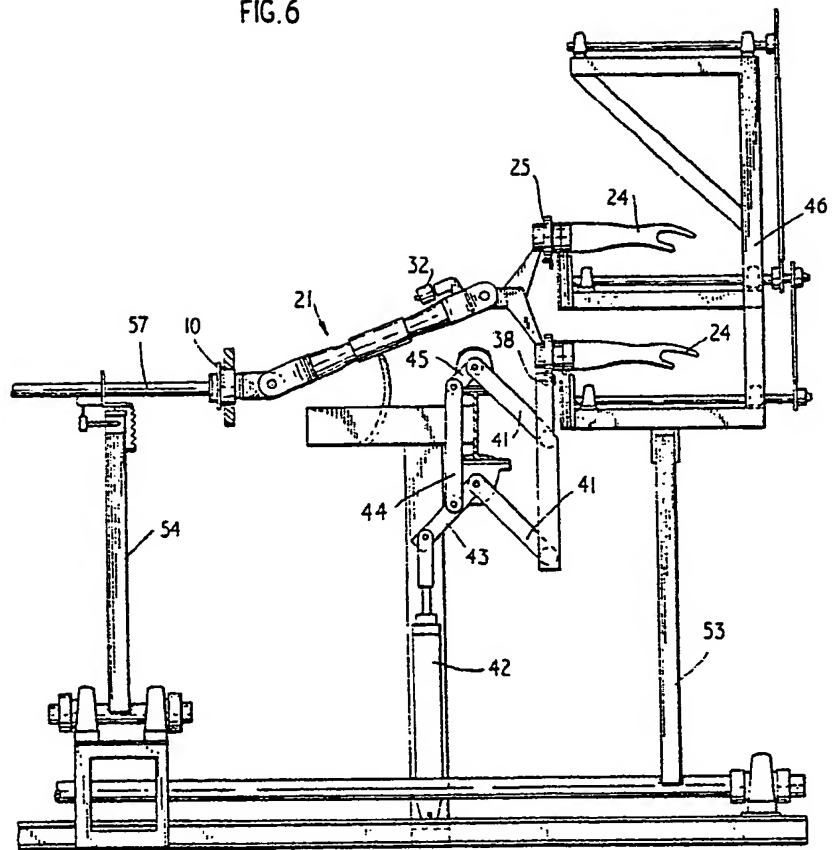
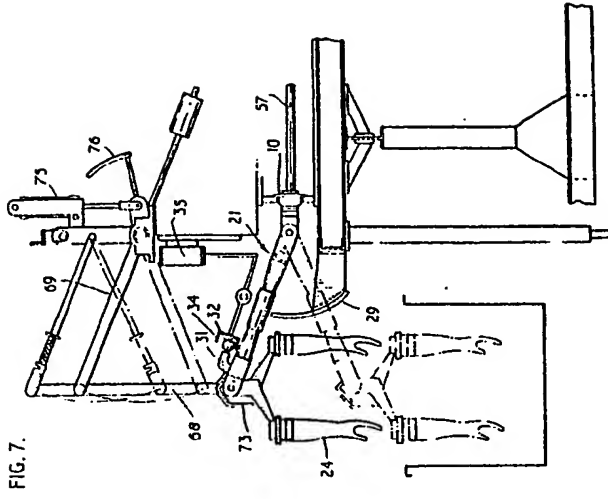
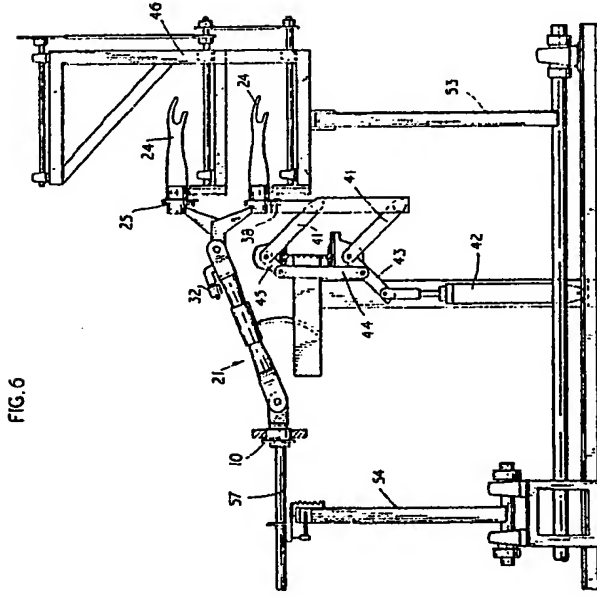


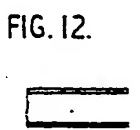
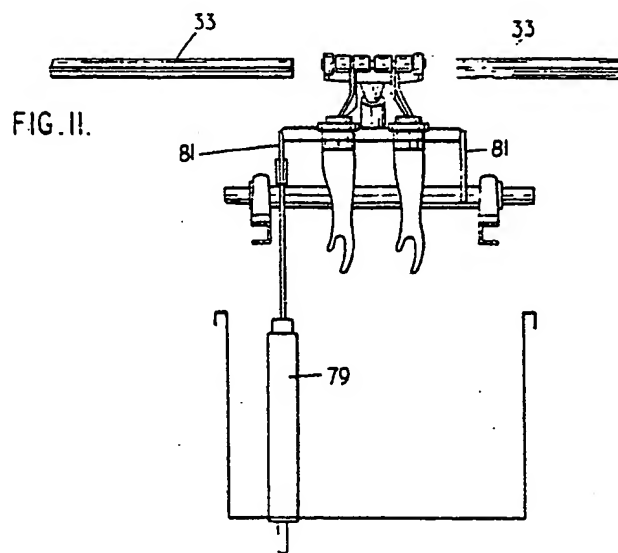
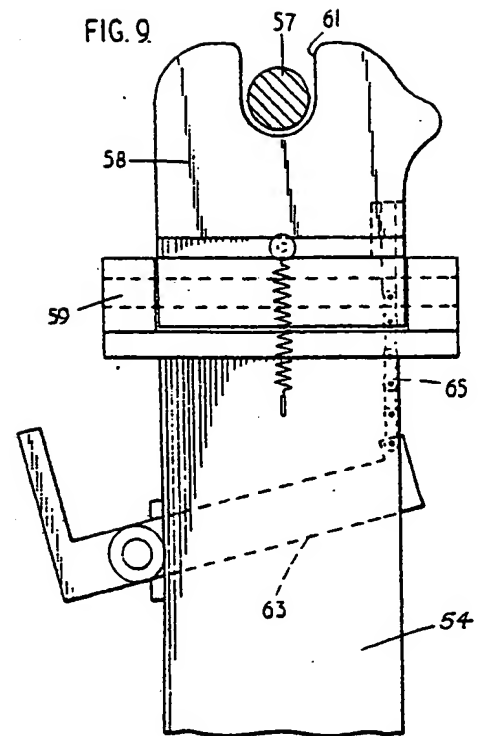
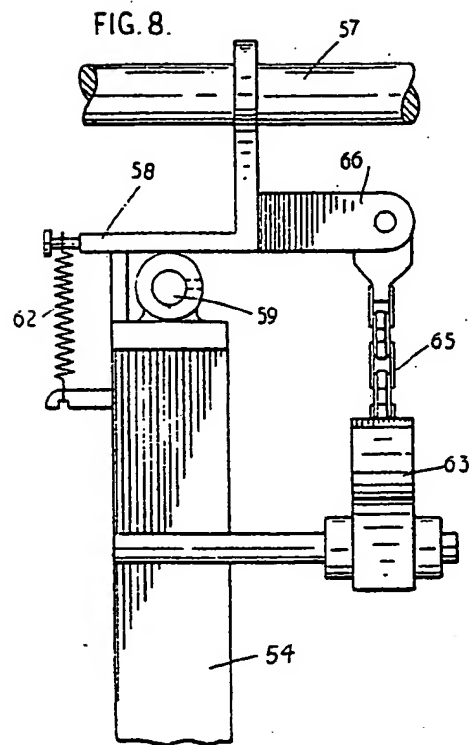
FIG. 6











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Sheet 5

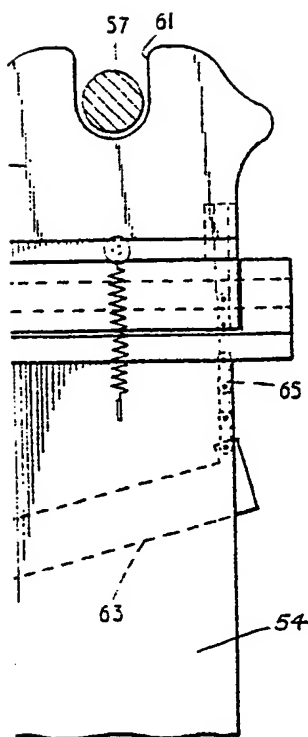


FIG. 10.

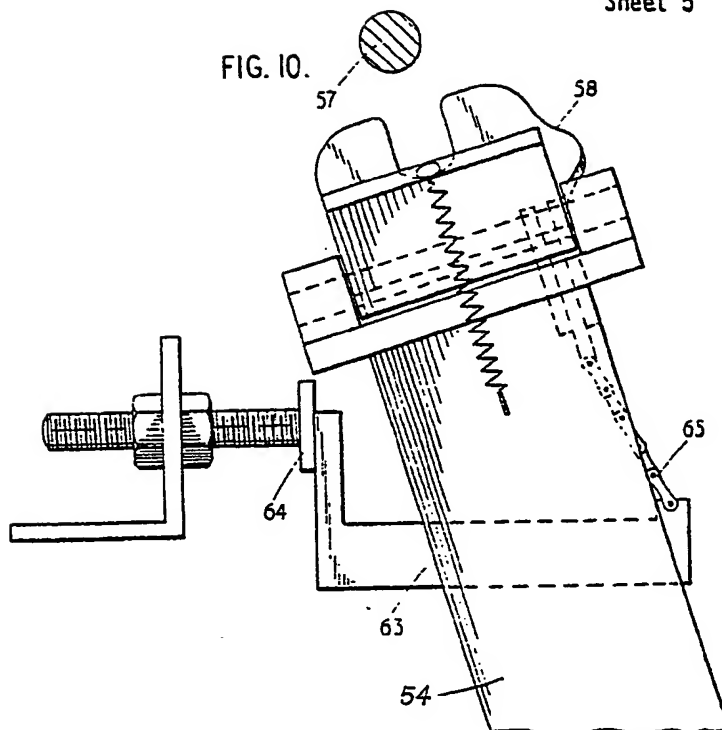
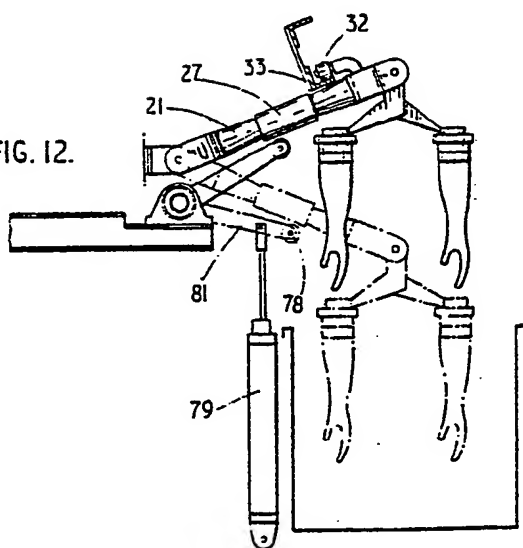
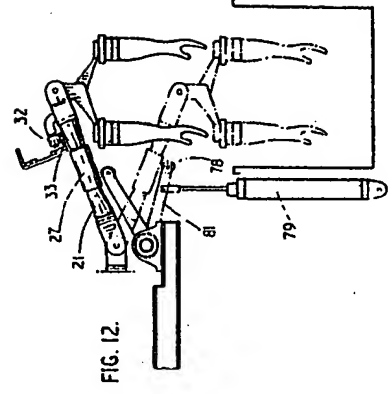
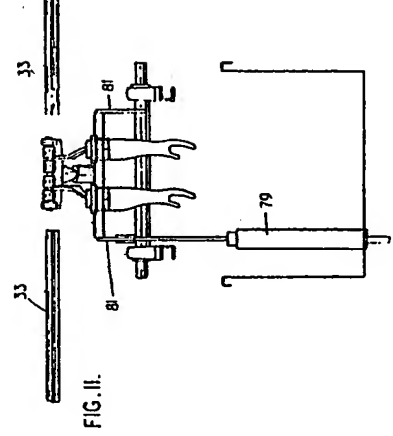
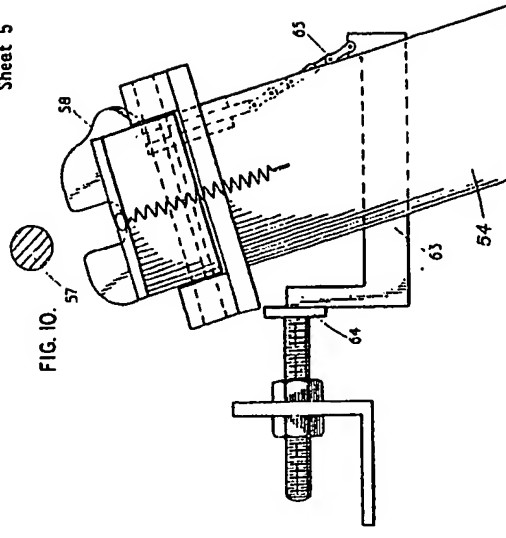
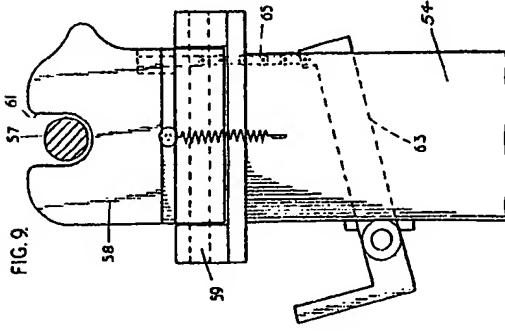
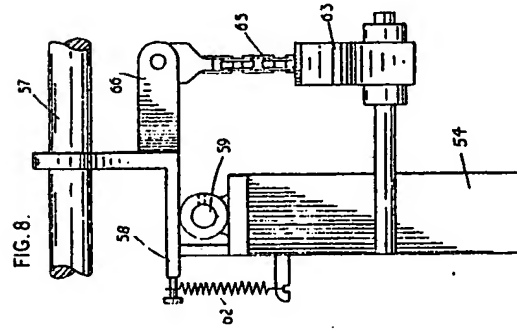


FIG. 12.





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